

Radiation

Safety

Committee

Minutes of Radiation Safety Sub-Committee of February 11, 2000

Shielding Design for E951 in the A3 Beamline

Present: D. Beavis, A. Etkin, E.T. Lessard, W. MacKay, R. Prigl, J. Scaduto, C. Schaefer, A. Stevens

Motivation: A preliminary shielding design for E951 in the A3 beamline was presented to the committee.

A description was distributed to the committee prior to the meeting (see attachment 1).

The shielding is designed based on the following operating parameters:

- 1) The experiment intends to run with up to 10^{15} protons/hour on a test target. Pulsed beam with intensities up to 10^{14} protons per spill are planned. An upper limit of 10 such spills an hour is expected with a typical request of 2-4 per hour.
- 2) Tuning with pulsed beam and the target out. This is expected to have intensities of 10TP/spill and 1000 spills per hours for a maximum 10^{16} protons/hour. The target will not be in place while this tuning is done.
- 3) The total intensity for a year of operation is expected to be $5 \cdot 10^{17}$ protons. This is based on a mix of tuning and target testing with 5 weeks of operation.
- 4) The pulsed beam will use single turn extraction.

The committee recommended that construction could start. The following items need to be reviewed or signed off before operations.

The pulsed beam can create large instantaneous energies in any materials that it may strike. The committee requests that the chief mechanical engineer review/sign-off on:

- 1) **(CK-A3-pulsed beam-Fy2001)** Transport elements from the AGS to the A3 dump. This should include potential damage due to abnormal running conditions such as a power supply tripping off.
- 2) **(CK-A3-Pulsed beam-FY2001)** Any target placed into the beam in the A3 area.
- 3) **(CK-A3-Pulsed beam-FY2001)** The A3 beam dump or any other dumped intended for use with the pulsed beam.

There is the potential for soil activation under the transport elements and the target. The area is capped with a 1-foot thick concrete floor and the building roof. These two elements prevent the possible leaching of soil. The liaison engineer for the experiment should review the building prints to ensure that there are no pipes or drains under the building slab which if leaking could leach any potential activation products from the soil. **(CK-A3-FY2001)**

The dose due to muons penetrating the beam dump was estimated using a formula by Sullivan. The 10^{15} protons per hour on target produce a dose rate of 0.1 mrem/hr of muons penetrating the dump. The tuning intensity of 10^{16} protons per gives a similar result. These numbers should be checked carefully with initial radiation surveys to ensure the uncontrolled area downstream of the beam dump is well within compliance. **(CK-A3-FY2001)**

The forward portion of the beam dump intended for the hadronic cascade has 6.5 feet of steel on top of a concrete pad. This should reduce neutrons sufficiently to avoid soil activation issues (an estimate of 600 Pico curies/liter was estimated if the concrete pad is ignored). The beam may activate materials on the steel including rainwater, which could subsequently flow into the adjacent soil. The committee recommends that either the beam dump be covered with a weather shield to prevent any leaching or an alternate plan be presented to the committee. **(CK-A3-FY2001)**

The hardonic portion of the beam dump should be modified to have a concrete cap. **(CK-A3-FY2001)**

The west side of the end wall to the A3 caves appears to be thin for beam on target. It is recommended that this area be made thicker. **(CK-A3-FY2001)**

A dose rate of 33 mrem/hr through the roof results with 10^{15} protons/hr on target. The stairs over the A line allow access to this portion of the roof. The roof must be posted as a radiation area. Consideration should be given to preventing access to this portion of the roof. **(CK-A3-FY2001)**

The dose rate through the sidewall shielding is estimated to be 10 mrem/hr with 10^{15} protons/hr on target. The adjacent areas to the sidewall should be radiation areas. **(CK-A3-FY2001)** Previously, the entire building has been posted as a radiation area. Some penetrations have been estimated to have potential levels of 200 mrem/hr with 10^{15} protons/hr on target. These areas will need to be carefully checked during low intensity commissioning or enclosed in a high radiation area. **(CK-A3-FY2001)**

It has been proposed to use several chipmunks outside the shielding of the new A3 cave. For pulsed beam operation the chipmunks and may see most of their dose in only a few pulses. This may represent a problem with setting an interlock level. Both the operation of the chipmunks and their location will require review at a later meeting. This review could be conducted after initial low intensity tests. **(CK-A3-FY2001)**

The primary beam may pass through air. The air activation should be estimated or a plan in place to handle potential air activation products. **(CK-A3-Fy2001)**

During proton operations both the A1 area and the A3 area need to be posted as activation areas. **(CK-A3-Fy2001)**

Residual activation surveys will need to be conducted to check the residual levels near the re-entrant cavity of the beam dump and the target area.

A review of the water system used for cooling will need to be done to ensure it meets all environmental requirements. **(CK-A3-FY2001)**

Attachments:

1) Memo from R. Prigl Feb. 4, 2000 (file copy)